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"PROGRESSIVE EDUCATION" IN THE TEACHING OF PATHOLOGY[1]

IN an article in the *Atlantic Monthly* of February, 1921, Mr. Stanwood Cobb describes "A new movement in education." The type of education which he considers has been given the name "Progressive Education." Although the article deals particularly with education in the primary grades, nevertheless, the question arises as to whether or not the principle which directs this movement may have application in more advanced technical education. A fundamental aim is to have the interest of the student aroused before his work is assigned. Although it might be presumed that the mere fact of a student's entrance into a school of medicine presupposes that his interest is sufficiently aroused to dictate the most active work in the furtherance of his technical training, yet all those who have taught in such schools know full well that such is not necessarily the case. The motives underlying the student's selection of a profession sometimes are extrinsic in origin; the purpose may have originated in the minds of parents or others. Again, the aim of the student may be different from the highest ideals of professional work. All too often the student regards certain of his subjects, particularly those of the preclinical years, as of little importance. Therefore, it becomes necessary to arouse interest on the part of a considerable number of students in any given class. Fundamentally, it might be assumed that were the teachers of the preclinical subjects to emphasize continuously the importance of these materials in the subsequent clinical work of the student that would be sufficient, but long experience in teaching pathology where this view has been particularly emphasized shows that even this

[1] From the department of pathology, school of medicine of Western Reserve University, Cleveland, Ohio.

method is not sufficient to attain the ideal. As a corollary to arousing interest on the part of children comes the proposition that "the best way to get the child to learn a thing is to make it want to learn that thing." These fundamentals of the progressive method of education in the earlier grades are attacked along four lines. They include (1) competitive games in which there is some opportunity for action, (2) the abandonment of the formal recitation, (3) a more flexible program, (4) correlation of book knowledge with the daily life of the child.

It is well understood that not only is primary education in an experimental stage but judging from the numerous attempts to elevate the standards of medical education, certainly this branch of technical training is also passing through a period of experiment. When one considers the reports presented before the Council on Medical Education in the spring of 1920 it becomes apparent that the same is true of the various subjects included in the medical curriculum. The question naturally arises as to how far the fundamental principles of progressive education may be applied to the subject of medicine as a whole or to any of its individual branches. The present communication deals only with the application to the course in pathology.

The principle of competition has been applied over years in the assignment of grades for work. In the minds of most teachers this is insufficient and often leads simply to intensive narrow work toward the attainment of high grades. Many students recognize in themselves a certain limitation of intellectual power and are not stimulated in any sense by the apportionment of grades. They recognize that all too often the students with highest grades are not necessarily the best practitioners or investigators. The same applies in the posting of excellent drawings or notes. Competition in actual practical work in pathology may, however, serve a useful purpose. In our own courses this is attempted by comparative efforts in actual work. Students are required to demonstrate to their classmates the fresh organs from recent autopsies. In certain instances they demonstrate microscopical preparations and the same principle is applied in the reporting of experiments. No grades are assigned for these efforts, but instead the attempt is made to stimulate the student's pride in his own attempts.

The abandonment of the formal recitation has met in our hands with the greatest success. Even with the utmost informality there was constantly before the student in ordinary recitations the desire to make a good impression on his teacher. It must be recognized, however, that in technical training there is in every subject a considerable content value and in the particular subject under consideration not only is this true but the aim of the teacher must be to stimulate the student to thinking logically in terms of medicine. Extremely successful in our work has been, under the stimulus of Mr. Cobb's article, the introduction of recitations conducted by the students. In the subject of special pathology this includes review recitations of the embryology, morphology, and physiology of organs and systems followed by similar recitations in pathologic disturbances. In adapting the method, the students elect for each recitation a director who is given sufficient time to prepare for this task. The students are requested to select their directors rather from the point of view of organizing ability and clearness and rapidity of thought than from the point of view merely of high class standing. This has resulted in a marked elevation of the standards of recitation. The results are shown in a greater cooperative spirit on the part of all concerned, a greater seriousness of purpose and attention and what appears to be a clearer understanding of the difficulties which each class faces. Naturally, such recitations must be closely supervised because of the necessity for maintaining accuracy. It might be objected that such a method leaves no room for the stimulation of the student's imagination. In practise, however, it is found that many questions brought up in the course of these informal discussions serve admirably in exciting speculation as to origins, process, results and relations of disease. Furthermore,

the lectures which are given can serve this important purpose equally as well as recitations. The informal recitation has the further advantage of permitting a better evaluation of the ability of the individual student than is possible with the more formal and more autocratic recitation conducted by the teacher. Inherent reticence of the student often prevents an answer to a teacher's question and yet permits of an adequate answer to the same question from one of his colleagues. The protection of the community and the maintenance of high standards in a school of medicine demand that the teacher form a proper estimate of the students' ability and this estimate can be materially aided by observation in the democratic and informal recitation.

A certain amount of flexibility in program is provided for in offering elective courses in the various divisions of special pathology. Considering the content value of a technical subject, it is difficult to adopt the program of flexibility to any very wide extent. Nevertheless, the principle can be applied without too great a sacrifice. Instead of assigning a certain number of slides for each day, a certain number of days can be given over to a particular subject; the total number of slides or other material can be indicated and the proportionate division of the work left to the student's personal wishes. Recognizing the fact that drawing illustrations of slides or other material has considerable value, nevertheless, flexibility may be adopted here. For example, the students of our present class have been told that fifty drawings are required in the subject of special pathology. Their selection of the subjects to be illustrated is of far more significance than is actual technical skill in drawing. No particular forms are given for the report of experiments and the method of presenting these reports gives the student complete freedom and serves as a guide to his grasp of the subject.

The correlation of the material acquired in pathology to the daily affairs of the student's and physician's life is a matter which has given the writer considerable concern. Fundamentally, this means the interpretation of pathology in terms of clinical medicine. The introduction of experiments to illustrate in animals these disturbances has been of the utmost vlaue. Simply performing the experiments is insufficient; they must be interpreted so as to demonstrate their application to human disease. The method adopted in our work has been described.[1] Even this proves insufficient and every opportunity must be taken to impress on the student the fact that the material he deals with comes from living patients. Correlation can also be approached by means of the clinical pathological conference, as adapted to the needs of students. In our courses eight periods of one and one half hours each are employed for this purpose. It is possible as a rule to cover two or three cases in each period. Two students of the third year class are required to present the history and differential diagnosis of a case that has recently come to autopsy. Following the discussion of this presentation, the organs from this patient are demonstrated by two other students either of the same class or of the second year class; this is succeeded by an attempt at correlation of symptoms and morphologic disturbance, as well as a discussion of the sources of error in clinical diagnosis. These exercises have proven to be most successful. In addition to these conferences the second year students at the end of the studies of the disease of the heart and of the diseases of the kidney take part in exercises which were first utilized with the cooperation of Dr. F. W. Peabody and are now being practised with the cooperation of Dr. R. W. Scott. These exercises have been described in detail[2] but they can be summarized by an illustration from a recent exercise. The students gathered in the

[1] Karsner, H. T., "The function of the experimental method in the course in pathology," *Boston Med. and Surg. Jour.*, 167: 511, 1912. Pearce, R. M., "The teaching of experimental pathology and pathological physiology to large classes," *Bull. Johns Hopkins Hospital*, 22: 249, 1911. Karsner, H. T., "Teaching the pathology of function," *Jour. Am. Med. Assn.*, 75: 361, 1920.

[2] Karsner, H. T., "The experimental method as utilized in the clinico-pathological conference," *Boston Med. and Surg. Jour.*, 170: 723, 1914.

amphitheater of City Hospital and demonstrated during the first hour the gross morbid anatomy of several fairly typical heart lesions. Recitation was then conducted by a student on the normal physiology of circulation. This was followed immediately by students' demonstrations of the effects in dogs of hydropericardium, of acute myocardial degeneration, of aortic stenosis and of aortic insufficiency. In line with the student's discussion of the normal functions of heart muscle Dr. Scott presented and discussed a few electrocardiographic tracings. After a brief rest the students then under Dr. Scott's direction examined three living patients exhibiting murmurs, thrills and cardiac arrhythmia.

It is hoped that as the experiment in progressive education is more widely applied to pathology the results will be improved, but even with the experience now at hand there is little doubt that this method has an application in pathology and that in so far as it has been attempted it has been proven to be eminently successful. Certainly, the idea is practicable and its success will depend upon the teacher's interest in the educational side of his subject, his willingness to grant as large a measure of freedom as possible to the students' own effort, his keenness in careful supervision and his confidence in the propriety of the idea.

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A NOVEL MAGNETO-OPTICAL EFFECT

(*Further Investigations*)

In the former account of this novel effect, it was pointed out that a microscopic examination of the iron arc smoke deposited on a glass surface gave evidence of the existence of fine particles of iron compound arranged in short chain sections of bead-like relation.

It is now thought that this peculiar formation may have its origin in the outer envelope of the arc flame where the particles are formed, and where they are lined up around the arc stream by the circular magnetism surrounding the current conducted by the hot vapor stream of the arc. The particles, being magnetic, would tend to form chains or rings surrounding the arc. These would not be stable, however, but would float away as they became shattered by gas currents, and remain only as short lengths of particles held together. To throw light on this possibility, a small vertical, hollow cylinder of plaster of Paris open above was arranged with iron electrodes (for forming an arc) passing through its sides and meeting in its center. By passing the current of a storage battery giving about 50 volts through them in contact and separating them, an iron arc could be produced at will within the plaster cylinder. The dimensions of the cylinder were such that a microscope slide 3″ x 1″ could rest across the open upper end of the plaster cylinder, only partly closing it, the slide lying horizontally above the arc electrodes at a distance of about 3 cm. Such a slide could receive a layer of smoke on its under surface when the arc was formed below it. The microscope in that case showed only a confused deposit.

When, however, there was placed above the slide a strongly excited electromagnet with its poles resting on the upper sides of the slide or close thereto, such poles being about 3 cm. apart, a smoke deposit of a remarkable character was produced. Even as examined by the unaided eye in diffused light, there was decided evidence of a structure or striation. When, however, the microscope was used, with even comparatively low powers of about 300 to 400 diameters, there was disclosed a decided striation seemingly composed of brownish particles in strings extending over the slide and following the direction of the field. There was noted a surprising regularity in the distribution or spacing of the striæ, as if the surface was covered with fibers laid on systematically side by side.

There were, however, curious objects composed of small spheres (evidently globules of iron) strung together in a line of two, three, four or more, such spheres having no uniform size. Most of these iron globule groups lay, of course, in the field direction and were very

large relatively to the particles in the striation covering the most of the surface of the slide. But each of these straight settings of globules possessed a singular appendage, generally at one end only, but sometimes at both ends. It consisted of a brush-like tail composed of the brown filamentous chains of particles like those covering the slide as noted above. They gave the appearance of tufts, suggesting a growth of beaded fibers from the end of the string of globules. By focusing, these tufts or tails could be seen as projecting outward (upward) in an inclined direction. This means that the tufts did not lie on the slide surface, but sprang outward from the globule which carried it. The globule at the other end of the short chain (generally the largest in the line) was often to be seen as having a convergence upon it of the usually parallel striæ of the other parts of the slide, indicating clearly that the globules strung together were acting as small magnets with poles at each end, towards and from which poles, the convergence and divergence of the magnetic lines was indicated by the fine striæ of particles taking their direction.

The polariscope showed that the striated smoke layer caught on the slide has the same property of scattering or diffusing light (as plane polarized light) that the smoke oriented in the air by a magnetic field has, but, of course, the slide preserves the orientation and needs, to produce the results, no magnetic field after its formation or deposition. The slide covered with the striated smoke film is, in fact, a polarizer.

Examination between crossed Nicol's prisms (dark field) discloses the fact that the tufts of fine fibers carried by the rows of globules, show as luminous spots on the black field, clearly indicating that the groups or tufts have a polarizing effect if they are in proper relation to the rays passing through.

As was to be expected, any hollow vessel or enclosure capable of retaining the smoke from an iron arc can be used in demonstrating the original luminous phenomenon. A glass flask of from 1 to 2 liters is readily sensitized, as it were, by holding its mouth over an arc for a short time, allowing smoke from the arc to enter, and then corking the flask. It may then be used to show the effects by allowing a beam of light to traverse it while held in the field of a current-carrying coil. While this was being done, it was noticed by Dr. Hollnagel of the laboratory that when the coil was traversed by an A.-C. current of twenty cycles, the flask, when near the coil, gave the usual effect of increased luminosity of the smoke in its interior. When, however, the flask was removed from the coil a distance of several feet, the steady luminosity was replaced by a flickering which kept pace, not with the alternations of current in the coil, but with the cycles only. The flickering was, as it appeared, at the cyclic rate. This flickering was noted even at a distance of twelve feet from the coil, although the coil was but 7 inches in diameter and about 2 inches in axial direction. The flickering is a curious effect, and it is difficult to explain, especially the fact that it appears to keep time with the cycles and not the alternations of current. It points to some sort of magnetic retention or polarization of the iron particles of the smoke. They may even rotate or oscillate in obedience to the field fluctuations, but there is needed much more work of investigation as to the cause of the peculiar behavior. The experiment clearly shows that a very moderate field intensity suffices for lining up the particles in the air, and so producing the luminous effect.

Emphasis is again given to the fact of the extremely small amount of iron particles suspended in the air, capable of giving a decided effect.

ELIHU THOMSON

THOMSON LABORATORY,
LYNN, MASS.,
June 17, 1921

SCIENTIFIC EVENTS

THOMAS HARRIOT[1]

THE tercentenary of the death of Thomas Harriot, the mathematician and astronomer, occurred on July 2. Not only was he the most celebrated English algebraist of his time, but

[1] From *Nature*.

he was also one of the first astronomers in England to use a telescope, and, like Galileo, Fabricius, and Scheiner, was one of the early observers of the spots on the sun. Born at Oxford in 1560, he was a year older than Henry Briggs. He graduated from St. Mary's Hall, and became an ardent student of mathematics forty years before the inauguration of the first university chair of mathematics. At the age of twenty-five he entered the service of Sir Walter Raleigh, by whom he was employed in the survey of the newly founded colony of Virginia. The greater part of Harriot's life, however, was passed in the neighborhood of London, where he came under the patronage of Henry Percy, Earl of Northumberland, who gave him a pension and assigned him rooms at Sion House, which stands on the banks of the Thames opposite Kew. When the earl was confined to the Tower through the complicity of some of his family in the Gunpowder Plot, Harriot and two other mathematical worthies, Thomas Hughes and Walter Warner, often bore him company. They were known as "the three magi." Harriot appears to have passed an uneventful life, and at his death was buried in St. Christopher's Church, on the site of which now stands the Bank of England. A monument erected to his memory was destroyed in the Great Fire of 1666. As an algebraist Harriot is a connecting link between Vieta and Descartes. His "Artis Analyticæ Praxis" was not published until ten years after his death. The revival of his fame as an astronomer was due to von Zach, who, while on a visit to the Earl of Egremont in 1784, discovered some of Harriot's writings beneath a pile of old stable accounts at Petworth Castle; while the reduction of Harriot's observations of the comet of 1607 formed one of the first tasks of Bessel's astronomical career. Some of Harriot's manuscripts are in the British Museum.

THE INTERNATIONAL INSTITUTE OF AGRICULTURE

The president of the International Institute of Agriculture at Rome has transmitted to the Secretary of Agriculture, through the State Department, a copy of resolutions adopted in April, 1921, by the permanent committee of the institute, authorizing the conferring of the title "Donating Member" upon any person who makes a gift, donation, or contribution to the institute amounting in value to 10,000 Italian lire, which at normal rates of exchange is equivalent to about $2,000.

The permanent committee wished to demonstrate in a tangible manner the gratitude of the International Agricultural Institute toward all persons whose generous impulse prompts them to make gifts to it in money or in kind, thereby contributing toward the fulfillment of the mission intrusted to it.

The permanent committee has already named as a donating member Mr. Victor Vermorel, member of the National Academy of Agriculture of France and former senator, thus testifying to him its gratitude for a generous gift which he made to it recently.

The International Institute of Agriculture was established as the direct result of the efforts of David Lubin, a successful merchant of California, with the active support of the King of Italy, who foresaw the advantages which would accrue to agriculture, commerce, and industry from an international clearing-house for systematically collecting and disseminating official information supplied by the various governments of the world on agricultural production, consumption, movements, surpluses, deficits, and prices of agricultural products, transportation, plant and animal diseases and insect pests, rural credits and insurance, standard of living, wages and hours of labor on farms, cooperative organizations of farmers, legislation affecting agriculture, and similar information. The international treaty was drafted at Rome on June 7, 1905, and has since been ratified by more than 60 governments.

The institute survived the trying period of the World War and is now entering upon a period of expansion and increased usefulness. Its work benefits all peoples. In accordance with the recent action of the permanent committee, which is made up of delegates from the adhering governments and serves as a board of directors of the International In-

stitute of Agriculture, citizens of the United States and other countries who are in sympathy with the purposes of the institute have an opportunity to contribute to its support and development and to receive permanent recognition therefor as "donating members" by having their names and nationality and the date of their donation inscribed on a marble tablet which will be placed in a conspicuous position in the halls or vestibule of the marble palace occupied by the institute, situated in a beautiful park on an elevation overlooking the Eternal City. Such donations can be made either through the Secretary of Agriculture, the Secretary of State, or the American delegate to the International Institute of Agriculture, Rome, Italy.

THE EDINBURGH MEETING OF THE BRITISH ASSOCIATION

As has already been noted here the British Association meets at Edinburgh beginning on September 7. It last met in that city in 1892 under the presidency of Sir Archibald Geikie. The president, Sir Edward Thorpe, will address the association on aspects and problems of post-war science, pure and applied. An evening discourse will be given by Professor C. W. Inglis on a comparison of the Forth and Quebec Bridges, and there will be an opportunity to visit the former. Another discourse will be given on Edinburgh and oceanography by Professor W. A. Herdman, who, as president of the association at Cardiff last year, proposed a new exploration of the oceans like that of the *Challenger*. Sir Oliver Lodge will give the opening of the three lectures to the citizens on "Speech through the ether, or the scientific principles underlying wireless telephony"; Professor Dendy will lecture on "The stream of life"; and Professor H. J. Fleure on "Countries as personalities." A special lecture, arranged in collaboration with Section M (Agriculture), for agriculturists will be given by Dr. E. J. Russell on "Science and crop production." Hitherto all addresses of the presidents of sections have been formally read, and never discussed, but in the present program, the following addresses are announced to initiate debates: Sir W. Morley Fletcher, on the boundaries of physiology; Professor Lloyd Morgan, on consciousness and the unconscious, opening the newly established section of psychology; Dr. D. H. Scott, on the present position of the theory of descent in relation to the early history of plants; Sir Henry Hadow, on the place of music in a liberal education; and Mr. C. S. Orwin, on the study of agricultural economics. Other addresses will be given on the problems of physics by Professor O. W. Richardson, on the laboratory of the living organism by Dr. M. O. Forster, by Dr. J. S. Flett on experimental geology, by Professor E. S. Goodrich on some problems in evolution, by Dr. D. G. Hogarth on the application of geography, by Mr. W. L. Hichens on principles by which wages are determined, and by Professor A. H. Gibson on water power.

SCIENTIFIC NOTES AND NEWS

THE South African Association for the Advancement of Science will meet next year at Lorenço Marques under the presidency of Dr. A. W. Rogers, director of the Geological Survey of the Union of South Africa.

THE council of the Royal Society of Medicine made, on July 6, the first award of its gold medal to Sir Almroth Wright, F.R.S., in recognition of his services to medicine during the war. The medal is awarded for original discovery in medicine and other allied sciences, or for the practical application of the results of previous investigations of other scientists, or for the most valuable contribution in any other way towards the progress of the art and science of medicine, preventive medicine, or surgery.

IT is reported that Professor Edouard Branly, of Paris, is to receive this year's Nobel prize for physics.

WE learn from *Nature* that the French Société de Géographie has celebrated its centenary. There was a reception for delegates at the house of Prince Roland Bonaparte, president of the society, and M. Millerand,

president of the French Republic, presided at the opening meeting, a gathering at which explorers and geographers from various parts of the world were present.

Dr. E. J. Russell, director of the Rothamsted Experimental Station, has been appointed a foreign corresponding member of the Reale Istituto Lombardo di Scienze e Lettere di Milano.

W. M. Smart, chief assistant at the Cambridge Observatory, has been appointed to the John Couch Adams Astronomership, recently founded in Cambridge University under a bequest from the late Mrs. Adams.

The board of regents of the University of Michigan has adopted congratulatory and laudatory resolutions in recognition of the services of Professor W. W. Beman, who has for fifty consecutive years been a member of the literary faculty and for thirty-four years head of the department of mathematics.

Professor Herbert E. Gregory, of Yale University, director of the Bishop Museum in Honolulu, has been awarded life membership in the National Geographic Society for his original contributions to geographic science.

Henry E. Allanson has been appointed assistant to the chief of the bureau of plant industry, Department of Agriculture. He is a graduate of Cornell University, and came to the bureau in 1911.

Professor Alexander M. Gray, director of the school of electrical engineering of Cornell University, has been granted leave of absence for the year 1921–22, because of ill health.

Dr. Walter Long Williams, professor of obstetrics and research in the diseases of breeding animals, has retired from the faculty of the New York State Veterinary College at Cornell University. Dr. Williams was a member of the original faculty of that college. For eighteen years he was professor of veterinary research and obstetrics and for the last seven years has devoted his time to the study of the diseases of breeding animals.

Dr. Edward Phelps Allis, Jr., has returned to his biological laboratory at Mentone, France, after some nine months in America.

An expedition on behalf of the State University of Iowa to the gulf coast of Florida was conducted by Professor H. R. Dill in the latter part of May. A collection of marine fishes was made which will be mounted for the museum.

The Hugo Müller lecture of the Chemical Society, entitled "The natural photosynthetic processes on land and in sea and air, and their relation to the origin and preservation of life upon the earth," will be delivered by Professor Benjamin Moore on June 16.

The geological library of 4,000 volumes and 15,000 geological specimens collected by the late Professor H. P. Cushing and his father-in-law, the late S. G. Williams, have been presented to Western Reserve University by Mrs. Cushing.

A monument in memory of the French chemist, Adolphe Wurtz, was unveiled at Strasbourg on July 5.

The death is announced at eighty-three years of age, of Professor Viktor von Lang, formerly professor of physics at Vienna.

The Mathematical Association of America and the American Mathematical Society will hold their summer meetings at Wellesley College, September 6–7 and 7–9, respectively. Two joint sessions will be devoted to a symposium on "Relativity." On the afternoon of the seventh, Professor Pierpont, of Yale University, will give a paper entitled "Some mathematical aspects of the theory of relativity," while on the forenoon of the eighth, Professor Lunn, of the University of Chicago, will speak on "The place of the Einstein theory in theoretical physics."

The regents of the University of California have granted $20,000 from the campus improvement fund to the Lick Observatory for the improvement of the grounds and buildings at Mount Hamilton.

The American Pharmaceutical Association

has available a sum amounting to about $360, which will be expended after October for the encouragement of research. Investigators desiring financial aid in their work should communicate before September 1 with Professor H. V. Arny, chairman A. Ph. A. Research Committee, 115 West 68th St., New York, giving their past record and outlining the particular line of work for which the grant is desired.

WE learn from the *Bulletin* of the Bureau of Fisheries that the first meeting of the International Committee on Marine Fishing Investigation was held at Montreal, on June 23, at the call of the Canadian representatives. The members present were: Representing Canada—W. A. Found and A. G. Huntsman; representing Newfoundland—James Davies; representing the United States—H. F. Moore, R. E. Coker and H. B. Bigelow. The committee adopted resolutions recommending the coordination of the statistical data collected by the several countries represented in respect to the offshore fisheries, particularly those for cod and haddock; that studies of the cod, including tagging experiments, be undertaken; and that the methods of marine research of the several countries be standardized. Tentative steps were taken toward giving effect to these recommendations. The next meeting of the committee will be held in Boston, on November 4.

A CONSERVATION conference, called by the Secretary of Commerce, met at the United States fisheries biological station, Fairport, Iowa, from June 8 to 10, 112 delegates having registered. The states represented were Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, South Dakota, Wisconsin, and the District of Columbia. The attendance consisted of fishermen, fish dealers, button manufacturers, engineers, sanitarians, conservationists, state and national fishery officials, and biologists interested in the study and conservation of the life of fresh waters. A number of resolutions were adopted advocating various measures for the conservation of interior waters for economic, æsthetic, and recreational purposes.

A CORRESPONDENT writes: "The Bureau of Economic Geology and Technology of the University of Texas faces the probability of a total suspension of its activities for the next two years, on account of the elimination of its appropriation by the university authorities, as a result of the reduced appropriation allotted to the university by the Finance Committee of the State Legislature, which is now in session. There is still a possibility that some money may be assigned to the bureau from the contingent fund of the university, and this may prevent its entire suspension. This bureau has produced in the last few years a considerable amount of stratigraphic and paleontological work, and is at present the most important agency in advancing the knowledge of the geology of Texas. During 1919–1921 it produced 14 bulletins, aggregating 1,979 pages. The publication of several important works will be indefinitely postponed in case of elimination of the appropriations. In addition to its purely scientific activities, the bureau maintains a department for the examination of well samples, a testing laboratory for structural and road materials, and a chemical laboratory which is carrying out an extensive research program on lignite, oils and clays."

THE *American Journal of Insanity*, Johns Hopkins Press, Baltimore, will hereafter be the official organ of the American Psychiatric Association (till now the American Medico-Psychological Association) and will be published as the *American Journal of Psychiatry*.

THERE has been organized at the University of Minnesota and the affiliated Mayo Foundation a branch of the Society for Experimental Biology and Medicine which will be known as the *Minnesota Branch* of the society. At the present time there are 23 members of this society in the University of Minnesota. It is planned to arrange regular meetings throughout the academic year for the presentation and discussion of original papers falling within

the general field of experimental biology and medicine. Abstracts of the papers presented will appear in the *Proceedings* of the parent society.

The graduate women in the science departments at Cornell University have recently organized a sorority under the name of Sigma Delta Epsilon. The membership is primarily limited to women engaged actively in research work; honorary membership has been extended to several women who have gained recognition in the scientific world. The society will have a house at which the members may live while at Cornell. The organization at present consists of twenty-five active members and eight honorary members. The officers are: Adele Lewis Grant, *president;* Katherine Van Winkle, *vice-president;* Josephine Overton Souders, *secretary;* Hazel Elizabeth Branch, *treasurer.*

UNIVERSITY AND EDUCATIONAL NEWS

About $400,000 of the $500,000 appropriated for building purposes at the University of Iowa by the last general assembly is to be expended for the erection of the first units of a new chemistry building. When completed the building will cost $1,000,000.

Dr. C. L. Metcalf, for the past seven years professor of entomology in the Ohio State University, has resigned to accept the position of professor of entomology and head of the department of entomology in the university of Illinois.

Herschel C. Smith, formerly deputy state highway engineer of Oklahoma, has been appointed assistant professor of highway engineering and highway transport at the University of Michigan, from which institution he graduated in 1913.

Dr. Alfred H. W. Povah, assistant professor of forest botany and pathology in the New York State College of Forestry since 1918, has resigned to accept the position of associate professor of plant pathology and associate pathologist in the Alabama Polytechnic Institute.

Cleveland P. Hickman, M.A. (Michigan), has been appointed instructor in zoology in West Virginia University.

Dr. John Howland, professor of pediatrics at the Johns Hopkins Medical School and pediatrician-in-chief of the Johns Hopkins Hospital, has declined the offer of the Medical School of Harvard University to become professor of children's diseases at that institution. He will remain at Johns Hopkins.

DISCUSSION AND CORRESPONDENCE

A LIVING GALVANOMETER

That differences in electrical potential are produced by protoplasmic activity is a well-known fact. This is especially true of muscular activity. The existence of electrical currents in tissues was proved by Schweiger in 1824 and by Nobili, who discovered the galvanometer. The string galvanometer was first used to detect these currents, although it was reasonably believed that such currents were present before the galvanometer was discovered. Such evidence was correctly given in a more rudimentary way by Galvani and Volta. With the introduction of the various kinds of galvanometers these electrical currents were easily demonstrated. At the present the various modifications of Einthoven's galvanometer are used in detecting electrical currents produced by the activity of various muscles and especially the heart and in obtaining electrocardiograms. In fact it is a very accurate method of obtaining a clinical picture of the condition of the heart in man.

The discussion and demonstration of the production of electrical currents by living organisms and especially man, never fail to fascinate students, however teachers have found themselves handicapped by the lack of a suitable galvanometer. In laboratory experiments of this kind, such as Galvani's experiment and the rheoscopic frog experiment an outside stimulus is necessary to demonstrate this. In the experiment where the sciatic nerve of a muscle nerve preparation is laid across the beating heart, the results are very

striking, but the demonstration of electrical currents in the human body would be usually regarded as impossible without a galvanometer. These difficulties are solved by the rather simple experiments cited below.

Recently, while making a nerve muscle preparation, the thigh muscles of the left leg of the frog were removed and the nerve on the same side isolated but not sectioned. The body was well moistened with physiological saline and lay on a glass plate which was also well moistened. The toes of the left foot were held in the left hand, while forceps, held in the right hand, were accidentally placed upon the body of the frog. Immediately a violent contraction of the muscles of the left leg occurred. This was so unusual that we investigated this further. The same results were obtained repeatedly. It must be noted here that one metal was used instead of two as in Galvani's experiment, and in place of the other metal the human hand was used. The current stimulating the nerve might have been due to the difference in potential between the metal and the hand, and for that reason we substituted the right finger for the metal previously used and obtained the same results. We therefore concluded that the nerve was stimulated by the action current of the human body, the electrodes being the fingers of the right and left hands and the indicator or the galvanometer being the contractions of the frog's muscles.

The same experiment was tried on a number of frogs and in every case we obtained the same results, although more striking in some preparations than in others. We found that by making contact with any part of the frog's body or even the saline solution on the plate the muscles contracted.

When a non-conductor was interposed between the toes and the hand we found that no contraction took place. When a non-conductor such as wood was used for the right electrode no contraction took place. We at first thought that the action current involved was that produced by the beating human heart, but the absence of the rhythmical contractions in the muscles of the frog negates this.

It has been noted in some cases that the contractions were very violent, even tetanic, and immediately afterwards hardly noticeable. We have no explanation to offer for this other than the varying electrical currents in the body.

GEORGE G. SCOTT,
JOSEPH TULGAN

DEPT. OF BIOLOGY,
COLLEGE OF THE CITY OF NEW YORK

AN EXCEPTION TO DOLLO'S LAW OF THE IRREVERSIBILITY OF EVOLUTION

IT has been claimed that most cases of apparent reversion to a primitive type in specialized organisms—such as the occurrence of three toes in the horse that Cæsar rode, or a reversion to the primitive number of petals in flowers, etc.—are to be explained simply as additions of supernumerary parts, comparable to polydactylism, or the addition of supernumerary digits to those normally present in man, cats, etc. Since so many cases of an apparent reversing of the evolutionary process apparently have to do with the number of the various structural features present, and are therefore open to the objection that we may be dealing with merely an addition of supernumerary parts to those normally present, it may be of some interest to cite a clear case of reversion to the primitive condition in structures in which there can be no possible question of the addition of supernumerary parts.

In the fruit fly *Drosophila,* as is true of practically all Diptera, there has been such a marked specialization of the metathoracic region that the sclerites of this segment of the thorax have been profoundly modified and reduced, especially in the tergal region; and the metathoracic wings have been reduced to mere knobbed threads, the halteres, which would not be recognized as the vestiges of wings, if we did not know that they are modified wings from their mode of development, etc. Dr. Morgan, however, has recorded a mutant of *Drosophila* which he describes as having a "double thorax," apparently not realizing the true nature of the parts in the

mutant in question. The metathorax of this mutant has apparently reverted to a condition approximating that occurring in the ancestors of the Diptera, in having a well-developed metanotum and other metathoracic sclerites, while the wings of this segment of the thorax, instead of being mere knobbed threads as in practically all Diptera, have become developed as comparatively broad wings, with a well-defined venation. I am hoping to be able to make a careful anatomical study of the thoracic structures of this mutant in the near future, and have offered this brief account merely as a preliminary note of an investigation which will be given more in detail in a later publication.

G. C. Crampton
Massachusetts Agricultural College,
Amherst, Mass.

SCIENTIFIC BOOKS

JONSTON'S NATURAL HISTORY OF FISHES

Through the courtesy of Mr. Carl L. Hubbs of the University of Michigan, I have been able to examine a very rare book, seldom recorded in bibliography, the particular edition apparently not at all.

Its author is John Jonston, or as he writes it, Johannes Jonstonus, M.D., and its title page reads:

> Johann Jonstoni | Historiae Naturalis | de | Piscibus | et Cetis | Libri V | tabulis quadraginta septem | ab illo celeberrimo | Mathia Meriano | aeri incisis ornata | ex scriptoribus tam antiquis | quam recentioribus | maxima cura collecti | quos | ob raritatum denuo | imprimendos suscepit. Franciscus Josephus Eckerbrecht | Bibliopola Heilbrunnensis | MDCCLXVII.

Following this and bound with it is another volume, with the same title except for the words "de Exangibus Aquatilis Libri IV., tabulis viginti." This treats of invertebrates.

As this work bears the nominal date of 1767, subsequent to the "Systema Naturæ," it merits consideration in the interests of stable nomenclature.

I find that it is throughout a compilation from earlier authors, the latest of which is Piso's edition of Marcgrave's "Historia Naturalis Brasiliæ," printed at Leyden in 1648. The sources of information are carefully and apparently accurately given in side-headings. There is some evidence of a system of classification. Book first, for example, treats of marine fishes. Title of those which are pelagic, Heading 1, of scaly pelagic fishes, and Article 1, "de Asellis" of various "cods." Most of the forms mentioned are indicated by Latin nouns, the Greek form often added, and occasionally a descriptive adjective gives a binomial form. I find, however, no trace of a binomial system of naming; the word species I have not noticed and the word genus, occasionally used, has no technical significance, meaning merely "kind."

The names used by Jonston could not enter scientific nomenclature even if the date of the publication were subsequent to 1758, a matter which may be open to doubt.

In Bosgoed's "Bibliotheca Ichthyologia et Piscatoria," 1874, page 9, is recorded a treatise by J. Jonston, with a similar but more extended title, said to be in five parts in two divisions ("dln.") with the dates 1650 to 1653, issued at Frankfort on the Main.

Apparently the volume before me is a reprint of the second "dealing" of this general work, as it bears a different date and the name of a different publisher. Bosgoed speaks of a new edition in Amsterdam in 1718, and an edition in Dutch in Amsterdam in 1660, translated from the Latin by M. Grausius. In advance proof sheets of the second edition of Dean's "Bibliography of Fishes," references are given to about a dozen editions in Latin or Dutch. One of these is dated 1677, but none 1767.

It may be questioned whether the date "MDCCLXVII" given on Libri IV. and V. alike is not a misprint for MDCLXVII. The appearance of the book and the absence of reference to any author later than 1648, would point in this direction. In any event, the names merit no consideration from systematists as, if really issued in 1767, it is merely an unmodified reprint of a pre-Linnæan,

non-binomial, unsystematic popular compilation.

The volume is effusively dedicated to "Wilhelmo VI Hessio Landgravio," whose titles and virtues his "devotus cliens" expounds at length.

DAVID STARR JORDAN

SPECIAL ARTICLES

ON A METHOD OF ESTIMATING THE NUMBER OF GENETIC FACTORS CONCERNED IN CASES OF BLENDING INHERITANCE

IN the early days of rediscovered Mendelism Bateson[1] suggested the idea that what was then known as blending inheritance might be a variety of Mendelism in which dominance was wanting, but in which several or many independent factors were involved. This suggestion was found to be in good agreement with much experimental work on quantitative characters subsequently carried on by Nilsson-Ehle, Tammes, Emerson and East, and others. It is now generally accepted as the most probably correct explanation of all varieties of intermediate or blending inheritance. Accepting this as a working hypothesis, have we any means of discovering *how many* factors are involved in cases of blending inheritance? Surely the number must be very different in different cases.

Noteworthy features of blending inheritance are the following: (1) F_1 is intermediate between the pure parental races, but not more variable than the more variable parent. (2) F_2 is likewise intermediate in character but is *more variable* than F_1 or either parent. (3) In F_3 and subsequent generations the variability decreases from the maximum suddenly attained in F_2.

In all varieties of inheritance, whether typically Mendelian or blending, the maximum variability is to be found in the F_2 generation. In ordinary Mendelian inheritance we are able to detect the number of genetic factors concerned by the number of phenotypes which are distinguishable in F_2 and by their numerical proportions. The F_1 generation is in strong contrast with the F_2 generation to which it gives rise, for F_1 is of a single type, if the parent races were pure.

In blending inheritance also, it is the F_2 generation which affords a clue to how many genetic factors are involved, not by the formation of clearly distinguishable types (for there is but one), but *by the amount of the variability of that single type in F_2 as compared with F_1.*

To make this clear, let us consider the numerical series commonly employed, by expositors of the multiple factor hypothesis, for explaining the increased variability of F_2 in blending inheritance. If two pure races differ from each other by a single genetic factor (which does not show the phenomenon of dominance), and if these two pure races are crossed, F_1 will be intermediate. F_2 will also be intermediate in part, but the parental classes will also reappear, and there will thus be three distinguishable classes in F_2, which correspond with the two parental types and the F_1 type respectively. The classes will be numerically as 1 : 2 : 1, as in the familiar case of the blue Andalusian fowl.

Now suppose that the pure parent races dif-

TABLE I

F_2 Distributions in Size Classes, when Inheritance is Blending and Involves from One to Six Independent and Equivalent Factors

Factors	Class Magnitudes (Top Row) and Frequencies (Below)													Standard Deviation
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1	1						2						1	$\sqrt{18}$
2	1			4			6			4			1	$\sqrt{9}$
3	1		6		15		20		15		6		1	$\sqrt{6}$
6	1	12	66	220	495	792	924	792	495	220	66	12	1	$\sqrt{3}$

[1] Report I. to the Evolution Committee of the Royal Society, London, 1902.

fer by two independent but equally powerful factors, neither of which shows dominance. F_1 will again be intermediate but of a single type and not more variable than either pure parent race. But F_2, by recombination of the two differential factors, will now consist of five graded types, two of which correspond with the parental types, while the remaining three are found in the intervening region at equally spaced intervals. If the several graded types are readily distinguishable one from another, they will be found to occur in the proportions 1 : 4 : 6 : 4 : 1. But if the types are so close together in appearance as not readily to be distinguishable, the distribution will resemble a probability curve.

Further, if three independent but equivalent factors are involved in a cross where dominance is wanting, the F_2 classes will number seven and their frequencies will be as 1 : 6 : 15 : 20 : 15 : 6 : 1.

Now, suppose that in these several hypothetical cases, the character under investigation is size, and that the amount of difference in size between the parents is in every case the same; let us say for convenience, 12 units (inches, pounds, or whatever the case may be). Then the several classes of individuals of which F_2 is composed will have the class magnitudes and frequencies shown in Table I.

For distributions, such as those shown in Table I., we can readily calculate standard deviations, which measure the variability of each array. See the last column of Table I. It will be observed that the standard deviation falls off rapidly as the number of factors involved increases. Inspection of the column headed "standard deviation" in Table I. will allow one to arrive at the law of decrease of the standard deviation with corresponding increase of factors. It is evident that as the number of factors is doubled, the standard deviation is halved under the radical sign. In other words, *to reduce the standard deviation by one half, the number of factors must be increased four fold.* With this point in mind one can extend as far as is desired the columns in Table I. headed "factors" and "standard deviation."

In Table I. the difference between the parents is assumed to be 12 units and the standard deviation is expressed in terms of those units. To give the table a general form, we might suppose the difference between the parents to be one unit. The standard deviation would then be only one twelfth as great. It is so given in Table II., wherein only the columns "factors" and "standard deviation" are entered from Table I.

TABLE II

Standard Deviation of F_2 Expressed in Per Cent. of the Difference between the Parent Races

Factors	Standard Deviation	Factors	Standard Deviation	Factors	Standard Deviation	Factors	Standard Deviation
1	35.35	13	9.75	44	5.32	144	2.94
2	25.00	14	9.50	48	5.10	160	2.79
3	20.41	15	9.12	52	4.87	176	2.66
4	17.67	16	8.81	56	4.75	192	2.55
5	15.81	17	8.53	60	4.56	208	2.43
6	14.43	18	8.33	64	4.40	224	2.37
7	13.33	20	7.90	68	4.26	240	2.28
8	12.50	24	7.21	72	4.16	256	2.20
9	11.78	28	6.66	80	3.95	272	2.13
10	11.18	32	6.25	90	3.60	288	2.08
11	10.64	36	5.89	112	3.33	320	1.97
12	10.20	40	5.59	128	3.12	384	1.80

In the foregoing discussion, it has been assumed that the parent races were completely homozygous and so deviod of *genetic* variability. If this were true of the parents, it would also be true of F_1. In that case whatever variability was exhibited by the parents or F_1 would be *non-genetic.* Under like environment F_2 would be expected to show a like amount of non-genetic variability. Hence in estimating the genetic variability of F_2 one would have to deduct from the total observed variability of F_2 an amount equal to the observed (non-genetic) variability of F_1.

In practise one would proceed as follows. First find the difference between the standard deviations of F_1 and F_2. Divide this by the difference between the parental means (the respective means of the two pure parent races). Multiply the quotient by 100. Now look in Table II. for the nearest corresponding number in the column "standard deviation." Op-

posite this will be found the number of factors indicated.

Let us take a specific example. Emerson and East[2] (1913, p. 59) studied (among other quantitative characters) the inheritance of weight of seed in crosses of two varieties of maize. The mean weight of a seed in one parent variety was 2.7 grams; in the other variety, it was 8.3 grams, *a difference of 5.6 grams.* The seeds of F_1 plants had a mean weight of 4.6 grams and a *standard deviation in weight of .639 grams.* The mean seed weight of F_2 plants was 6.0 grams and the *standard deviation for F_2 was 1.17 grams.* The difference between the standard deviations of F_1 and F_2 is $1.17 - .639 = .531$ grams. This is to be divided by the difference between the parental means, which was 5.6 grams. Now $.531/5.6 = .0948$, which multiplied by 100 gives 9.48 per cent. Looking in the column "standard deviation" in Table II., we find the indicated number of factors to be 14.

Emerson and East made two other crosses between these same varieties of maize, but used different individuals as the parents in each cross. The results for the other two crosses may be compared with the case just discussed to test the reliability of the method. In one case, the standard deviation of F_2 was 1.089, making the difference between F_1 and F_2 .45. Now $(.45/5.6) \times 100 = 8.03$ per cent., which corresponds with the result expected from about 19 factors. In the other case the standard deviation of F_2 was 1.23, making the difference between F_1 and F_2 .591. But $(.591/5.6) \times 100 = 10.55$ per cent., indicating 11 factors. The three different lots of F_2 individuals thus indicate the factorial differences between the parents crossed to have been in one case, 11 factors; in a second case, 14 factors; and in a third case, 19 factors. It is rather probable that the parent races were not homozygous, maize rarely is. But the indicated mean difference between the parent races would be about 15 factors.

It is evident that the method has some serious limitations in its applicability. It applies perfectly only to cases in which the parents are genetically pure, that is, are homozygous for all factors affecting the character under investigation. Such material is rarely met with even in self fertilizing plants. If either of the parent races is in any degree variable genetically (heterozygous), F_1 will be variable in like degree. This will tend to *decrease* the difference in variability between F_1 and F_2 and so to *increase* the indicated number of factorial differences between the parents. This difficulty can be offset in part by raising an F_2 generation derived from all classes of F_1 in the proportion of their occurrence. It is obvious that when a variable F_1 is obtained, various classes of F_1 individuals should be tested as to their genetic character, and if they are found to be genetically diverse, each should have proportionate representation in the F_2 population.

The theory of multiple factors in blending inheritance assumes that each factor is equal to every other factor in its influence on the character affected. It is improbable that this is strictly true, but no other assumption will

[2] "The inheritance of quantitative characters in maize," *Res. Bull.*, 2, Agr. Exp. Station, Nebraska.

TABLE III

Estimation of the Number of Genetic Factors Influencing Weight Involved in Crosses of Certain Races of Rabbits

Cross	Standard Deviation F_2	Standard Deviation F_1	Difference between F_2 and F_1	Difference between Means of Parent Races	Factors Indicated
Polish × Himalayan	233	212	21	471	56
Himalayan × Flemish	230	162	68	1,725	80
Polish × Flemish	257	198	59	2,196	176

permit of a general treatment of blending inheritance. If one attempts to apply to each case a scheme of specially weighted factors, as Punnett has done for size inheritance in fowls and rabbits, he proves nothing except the fact that a factorial explanation of his results is possible, for by properly weighting factors and assuming that some inhibit the action of others, one can fit to his observations a scheme involving either few or many factors. If one factor really has an influence greatly superior to that of other factors in a case of blending inheritance, this will be seen in the production of asymmetrical or multimodal variation polygons in F_1 and F_2. If, when adequate numbers are produced, the variation curves of F_1 and F_2 are both smooth, it is certain that no genetic factor of predominant influence is involved in the case, but that several or many factors substantially equal in influence are concerned. Whether many or few can perhaps be ascertained by the method suggested in this paper.

I have recently applied it in the study of weight inheritance in crosses between races of rabbits differing in size, with the following results. Three races of rabbits were crossed in all possible ways. The average size of the smallest race, Polish, was 1,404 grams; of the second race, Himalayan, it was 1,875 grams; of the third race, Flemish, it was 3,600 grams. The number of factors indicated as differentiating the races in weight is in the order of magnitude of the differences between the races. See Table III. But the number of factors indicated as differentiating the smallest race from the largest (Polish from Flemish) is apparently too great, since it exceeds the sum of the differences in number of factors indicated as existing in the other two crosses. It is perhaps not to be expected that results more than approximately correct would be given by this method, unless fairly large numbers of both F_1 and F_2 individuals have been studied. In the rabbit crosses, the numbers of F_1 individuals studied were 16, 25, and 27, respectively. The F_2 numbers were 50, 62, and 112. The results obtained are sufficient to indicate the probability that in the Polish $\times$ Himalayan cross, 50 or more factors are involved, and that the crosses with the largest race, Flemish, involve two or three times as many factorial differences. A fuller discussion of this case will be published later.

W. E. Castle

Bussey Institution,
May 27, 1921

THE UTAH ACADEMY OF SCIENCES

The fourteenth annual convention of the Utah Academy of Sciences met in the physics lecture room of the University of Utah, Salt Lake City, on Friday evening, April 1, 1921, and continued for three sessions, closing Saturday afternoon with a business session at which the following officers were elected for the ensuing year.

President, Dr. Frank L. West, Utah Agricultural College, Logan, Utah.
First Vice-president, Professor Hyrum Schneider, University of Utah, Salt Lake City.
Second Vice-president, Professor Carl F. Eyring, Brigham Young University, Provo.
Secretary, A. O. Garrett, East High School, Salt Lake City.
Corresponding Secretary, C. Arthur Smith, East High School, Salt Lake City.
Councillors, Professor Harold R. Hage, University of Utah; Dr. M. C. Merrill, Utah Agricultural College, Logan; R. A. Hart, U. S. Reclamation Service, Salt Lake City.

Twenty-seven new members were added to the academy's roll of membership, making the largest increase in any one year in the history of the academy.

The academy voted unanimously to support the following resolutions:

Whereas: There is a greatly increased appreciation and use of the recreation and scenic resources of Utah to which an abundant supply of wild life is of great importance in furnishing an opportunity for nature study, fishing and hunting;
Whereas: The maintenance of proper forest conditions is necessary for the preservation and production of fish and game;
Whereas: Proper measures to insure a continued supply of fish and game must be based on a scientific knowledge of biological factors involved;
Therefore, be it resolved, That the Utah Academy of Sciences:
1. Emphasize the close relationship between our forests and fish and game conservation.
2. Endorse the recognition by the Forest Service that the fish, game and wild life on the National Forests are valuable resources to be preserved and maintained.
3. Cooperate with the sportsmen, the State Game Department, and Federal departments in order that proper measures to perpetuate the fish and

game be undertaken and that the general public, especially the youths, be informed regarding our wild life and the necessity for its protection.

WHEREAS: The rapid increase in population of the United States and Canada with its consequent use of agricultural and forest land is threatening the extinction of many native species of plants and animals, and

WHEREAS: The preservation of such native species is greatly to be desired, be it

Resolved: That the Utah Academy of Sciences endorse the work of the Ecological Society of America in the movement for the preservation of natural conditions in the United States and Canada.

Resolved: That it is particularly important that areas with typical plant and animal communities in different states of the union and the provinces of Canada be preserved and allowed to go on with their natural successional changes for the benefit not only of students who are interested in these subjects at the present time, but also and more particularly for future generations.

Resolved: That this Academy hereby requests the National Research Council to take cognizance of this important subject and requests said National Research Council to aid in whatever manner may be possible the work of the Ecological Society of America in securing vegetation and animal preserves and sanctuaries for the furtherance of scientific study.

Resolved: That a copy of these resolutions be forwarded by the corresponding secretary to Dr. C. E. McClung, chairman of the Division of Biology and Agriculture of the National Research Council.

WHEREAS: It is recognized that the timber supply of the nation is rapidly becoming depleted;

WHEREAS: The forest resources are of the greatest importance in the economic and industrial development of Utah and of the entire nation;

WHEREAS: The maintenance of proper forest conditions on important watersheds is conducive to a regular and continued stream flow and an adequate supply of pure water so essential for domestic, hydro-electric and irrigation use;

Be it resolved: That the Utah Academy of Sciences strongly endorses the conservation of forests to the extent of maintaining all potential forest land in a highly productive condition. With this purpose in view, we therefore, strongly urge the adoption of a national forest policy for the entire nation similar to that proposed in H. R. 15,327, introduced in the 3d Session of the 66th Congress, commonly known as the "Snell Bill."

Therefore, be it further resolved: That the Corresponding Secretary be instructed to transmit copies of this resolution to the members of Congress from Utah.

The following papers were read at the three sessions of the convention.

FRIDAY EVENING, APRIL 1

Symposium of Forests Conservation in Utah

Making the forest of Utah a permanent resource, C. F. CORSTIAN, U. S. Forest Service, Ogden, President of the Academy.

Fungus forest tree diseases of Utah, A. O. GARRETT, East High School, Salt Lake City.

Forest and fish and game conservation, S. B. LOCKE, U. S. Forest Service, Ogden.

Forests in relation to climate and water supply of Utah, J. CECIL ALTER, U. S. Weather Bureau, Salt Lake City.

SATURDAY A.M.

Analytical distillation of shale oil, M. J. GAVIN, U. S. Bureau of Mines, Salt Lake City.

The use of the microscope in ore dressing, R. E. HEAD, U. S. Bureau of Mines.

Destructive distillation of oil shale, L. C. KARRICK, U. S. Bureau of Mines.

Chemistry of the volatilization process, THOMAS VARLEY and C. M. BOUTON, U. S. Bureau of Mines.

Metallurgy of the volatilization process, C. C. STEVENS, University of Utah.

Function of steam in retorting oil shales, M. J. GAVIN, U. S. Bureau of Mines, and J. J. JAKOWSKY, University of Utah.

Reduction of copper from chloride fumes, R. H. BRADFORD, University of Utah.

SATURDAY P.M.

Decomposition of green manure at different stages of growth, THOMAS L. MARTIN, Millard Academy.

The normal temperature as a function of the time, elevation above sea level and the latitude, FRANK L. WEST, Utah Agricultural College.

Vitamines in relation to nutrition, W. E. CARROLL, Utah Agricultural College, Logan.

Relation of precipitation to height growth of forest tree saplings, CLARENCE F. KORSTIAN, U. S. Forest Service.

A twelve o'clock luncheon was given to the members of the academy and their friends at the university dining hall under the efficient direction of Miss Lucy Van Cott, dean of women, University of Utah. Dr. Frank L. Harris, of the Agricultural College, spoke at the luncheon on the general topic of scientific research, emphasizing the importance of stimulating an appreciation of its results in the public mind.

C. ARTHUR SMITH,
Corresponding Secretary

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION H—ANTHROPOLOGY

At the Chicago meeting of Section H—Anthropology—the following officers were nominated:

Vice-president (1921), A. E. Jenks, Minneapolis, Minn.

Secretary (Jan., 1921–Dec., 1924), E. A. Hooton, Cambridge, Mass.

The following members of the Sectional Committee were elected: B. Laufer (Jan., 1921–Dec., 1924), Chicago, Ill.; F. C. Cole (Jan., 1921–Dec., 1922), Chicago, Ill.

The Sectional Committee is constituted as follows: A. E. Jenks, chairman, Minneapolis, Minn.; E. A. Hooton (Jan., 1921–Dec., 1924), Cambridge, Mass.; Aleš Hrdlička (Jan., 1920–Dec., 1923), Washington, D. C.; Berthold Laufer (Jan., 1921–Dec., 1924), Chicago, Ill.; R. J. Terry (Jan., 1920–Dec., 1921), St. Louis, Mo.; F. C. Cole (Jan., 1921–Dec., 1922), Chicago, Ill.; Clark Wissler (1921), from the American Anthropological Association, Washington, D. C.; J. Walter Fewkes (1921), from the American Anthropological Association, Washington, D. C.

The following papers were read and discussed:

The practical value of anthropology to our nation: A. E. Jenks, University of Minnesota.

The grouping of Piman languages upon a phonetic basis: J. A. Mason, Field Museum of Natural History.

A project for the study of race mixture in the United States: E. A. Hooton, Harvard University.

The peopling of Asia: A. Hrdlička, U. S. National Museum.

The influence of sex and stock upon the pubic bones: T. Wingate Todd, Western Reserve University.

Variations in the weight of new-born children with particular reference to racial differences; comparative growth of premature and normal children: E. E. Scammon, University of Minnesota.

A bird's-eye view of American languages north of Mexico: E. Sapir, Geological Survey, Canada.

The scaphoid type of scapula: W. W. Graves, St. Louis, Mo.

The native culture of the Czecho-Slovak people and its relation to other European cultures: K. Chotek, Ethnographical Museum, Prague.

The present state of anthropological research in the Philippines: F. C. Cole, Field Museum of Natural History.

The relative dating of Aztec and Pueblo Bonito ruins, by growth rings on the timbers: A. E. Douglass, University of Arizona.

Aztalan: S. A. Barrett, Milwaukee Public Museum.

Anthropology at the Pan-Pacific Congress: Clark Wissler, National Research Council.

The American plant migration: Berthold Laufer, Field Museum of Natural History.

The criteria for a general, ancient Algonkin culture: Alanson Skinner, Milwaukee Public Museum.

The Ridatsa Indian: Care and training of the dog and horse: Gilbert L. Wilson, Macalester College.

The preservation of Indian remains in Wisconsin: Chas. E. Brown, Sec., Wisconsin Archeological Society.

The following papers were read by title:

Geographical influences upon human culture with special reference to the Great Plains: Melvin R. Gilmore, State Historical Society of North Dakota.

The technique of paleopathology as applied to human remains: Roy L. Moodie, University of Illinois, College of Medicine.

Aboriginal population in California: A. L. Kroeber, University of California.

Some vital aspects of the American Indian: Frederick L. Hoffman, Prudential Life Insurance Company.

Waning stone age industries among the Wisconsin Indians: Alanson Skinner, Milwaukee Public Museum.

Current illogical extravagant estimates concerning the antiquity of man: G. Frederic Wright, Oberlin College.

The afternoon session of December 29 was devoted to a conference on State Archeological Surveys.

On the afternoon of December 30, the section visited the Field Museum of Natural History to inspect the anthropological exhibits and afterwards visited the Newberry Library for an examination of the Ayer collection of Americana.

E. A. Hooton,
Secretary, Section H